

**Report of the Director's Review Committee on P-954:  
"Bringing the SciBar Detector to the Booster Neutrino Beam"**

October 18, 2005

Review Committee:

Gina Rameika, Fermilab (Chair)  
Dixon Bogert, Fermilab  
Dan Marlow, Princeton (PAC)  
Stephen Parke, Fermilab  
Peter Shanahan, Fermilab  
Bob Tschirhart, Fermilab

A Director's Review of P-954 was held at Fermilab on October 11, 2005. The Committee heard a series of presentations from the spokespersons, T. Nakaya (Kyoto University) and M. Wascko (Louisiana State University). The Committee would like to thank the proponents and their collaborators for the detailed and interesting presentations and the effort that went into the preparations for the review. The Committee's comments are presented here.

This proposal was presented with an author list consisting of 10 institutions and ~40 people. The Committee noted that in some cases the senior members of an institution were not listed. The proponents explained that the names listed were just those who had done the work in preparing the proposal documents.

*The Review Committee recommends that the proponents make a more complete list of the collaborators, indicating the commitments of all who would be participating, or supporting via grants and advising, etc.* The Committee acknowledges that the scale of this project is well suited to affording visibility to younger physicists, but notes that documented commitments from senior members is also important to ensure the success of the project. Moreover, it is important that there be a core group of individuals willing and able to commit a significant fraction of their time to making sure that the experiment would be installed, commissioned and analyzed in a timely way.

The proponents have explored a number of options for placing the detector. Although locating the detector on the surface would result in significant savings, the proponents have convincingly demonstrated that the physics advantages of placing the detector on axis (and thus below the surface) justify the added expense. The Committee agrees with the conclusion of the proponents that the optimum location for the detector is on the beam axis, which implies that the detector must be situated in an enclosure below grade level.

The cost of the required enclosure dominates the overall cost of the project. A preliminary/conceptual design of the enclosure was made by Tom Lackowski and Steve Dixon from FESS. The basic design is a simple concrete bunker style enclosure, ~14'x16' in cross section, containing two levels below grade, with access at grade level and a removable roof.

Equipment is lowered into the enclosure via a mobile external crane. The preliminary cost estimate for the enclosure, including site work and utilities is ~\$285K. This is the estimate for the “bid” contract cost, including the contractor’s overhead and profit. It does not include EDIA or contingency. Including these gives a preliminary estimate of just over \$500K.

It is the Committee’s view that the enclosure as laid out is a “tight fit”, which could lead to problems. *The Committee feels that more investigation is needed in the areas of confined space, life safety and fire suppression. The Committee recommends that the proponents prepare a more detailed drawing that shows that the actual detector components (not just a footprint) fit into the enclosure and have adequate space around them for needed access. In addition, the proponents should provide confirmation that the environmental controls that have been costed in the design are actually matched to the technical needs of the detector.*

In general, the Committee felt that the \$500K estimate might end up being a bit low, but not off by more than at most 50%--i.e., the building is well under \$1M.

There are three main components of the SciBar Detector. Two of these, the SciBar modules and the electromagnetic calorimeter would be shipped from Japan and reassembled here at Fermilab. The Committee does not expect problems related to these parts of the detector as they have been operated successfully in the K2K beam. In fact, the Committee was quite impressed with the detector resolution as indicated by the event displays that were shown. The third piece of the detector is a Muon Range Detector (MRD), which is proposed to be constructed at Fermilab from parts recycled from previous experiments. Currently, the proposal does not give enough detail for the Committee to evaluate the MRD's optimization, full potential performance, or feasibility and, most importantly, cost implications. The proponents state that the cost will be minimal since it is all existing equipment. *The Committee recommends that the proponents prepare a document/plan that demonstrates this.*

*Once the MRD is better defined, the Committee recommends that the proponents check that their initial estimate of three relay racks to hold electronics and readout equipment is adequate.* This is important because it has implications for the enclosure layout and power distribution.

The Committee notes that the experiment would be scheduled to begin in the early part of FY07. The MiniBooNE experiment is not at present approved to run beyond ~ the end of FY06. *The Committee recommends that the proponents determine (presumably with the help of colleagues in the Accelerator Division) the incremental cost of one year of running the Booster Neutrino beam line. Likewise, the proponents should evaluate the impact of this experiment on other Laboratory divisions.* The Committee expects that it will not be large, but this is best verified by preparing an itemized list, which includes manpower resources required from both the Particle Physics Division (technician and engineering support) and the Computing Division (for example, network or data acquisition support, or PREP equipment).

*In the area of physics justification, the Committee feels that the proponents should be prepared to present more quantitatively how results from the SciBar detector can be used to improve the systematic errors in the MiniBooNE analysis, and how that can improve the oscillation sensitivity.* The Committee recognizes that this is most relevant to an oscillation measurement

made with anti-neutrino running, but feels that the results regarding both neutrinos and anti-neutrinos are important. The Committee also suggests that the proponents be prepared to discuss why it is important to do the cross section measurements in the T2K energy regime, prior to actually running the T2K beam.

A specific physics question raised by one member of the Committee was, for the single pion cross section measurements, what is the overlap between the neutrino energy spectrum of the BNB and the energy spectrum of the neutrinos which produce  $\pi^0$ 's which fake  $\nu_e$  in the off-axis T2K neutrino beam?

*Finally, the Committee recommends that the proponents consider the advantages and disadvantages of locating the SciBar detector in the NuMI beam line rather than the Booster neutrino beam line. In particular, the possibility of a feasible, off-axis location in the NuMI Near Hall where an acceptable spectrum, rate and level of background could be found to achieve some or any of the proposed physics goals, should be investigated.*